

Outcome 3 - The Chain Rule for Advanced Higher derivatives

Worked Example 1:

Differentiate $y = \ln 7x$

Let
$$y = \ln u$$
 where $u = 7x$

$$\frac{dy}{du} = \frac{1}{u} \qquad \qquad \frac{du}{dx} = 7$$

$$\frac{du}{dx} = 7$$

$$\frac{dy}{dx} = \frac{7}{u} = \frac{7}{7x}$$

Worked Example 2:

Differentiate $y = e^{\cos x}$

Let
$$y = e^u$$
 where $u = \cos x$

$$\frac{dy}{dy} = e^{i}$$

$$\frac{dy}{du} = e^u$$
 $\frac{du}{dx} = -\sin x$

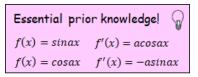
$$\frac{dy}{dx} = -\sin x \, e^u = -\sin x \, e^{\cos x}$$

Questions...

Differentiate each of the following with respect to x.

$$3 \qquad y = \ln(x^2 - x - 6)$$

Key Facts/Formulae: The chain rule enables us to differentiate a function within a function. $f'(outside) \times f'(inside)$ E.g. If y=u, then $\frac{dy}{dx}=\ \frac{dy}{du}\times \frac{du}{dx}$



Advanced Higher Formula sheet	
f(x)	f'(x)
tan x	sec ² x
$\cot x$	-cosec ² x
sec x	sec x tan x
cosec x	-cosec x cot x
$\ln x$	$\frac{1}{x}$
e^x	e ^x

Formulae N		
f(x)	f'(x)	
$\ln f(x)$	$\frac{f'(x)}{f(x)}$	
$e^{f(x)}$	$f'(x)e^{f(x)}$	

Answers

$$\frac{dy}{dx} = \frac{3}{3x}$$

$$\frac{dy}{dx} = \frac{2x-1}{x^2-x-6}$$

$$\frac{dy}{dx} = -\frac{12}{(4x+7)^4}$$

$$\frac{dy}{dx} = 6e^{6x+1}$$

$$\frac{dy}{dx} = 3x^2e^{x^3}$$